# Health Consultation

Evaluation of Air Exposure

POTLATCH PULP MILL
(a/k/a POTLATCH CORPORATION)

LEWISTON, NEZ PERCE COUNTY, IDAHO

EPA FACILITY ID: IDD009061375

SEPTEMBER 19, 2003

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

**Health Consultation: A Note of Explanation**

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared by:

Bureau of Environmental Health and Safety
Division of Health
Idaho Department of Health and Welfare
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

## SUMMARY


**What is the purpose of this health consultation?**
Potlatch is an active facility located relatively close to the downtown area of Lewiston, Idaho (Nez Perce County) and Clarkston, Washington. It is also the major industrial facility in the Lewiston area. The air emissions from the facility have the potential to impact the residential and business areas of the Lewiston/Clarkston Valley. Additionally, The Idaho Department of Health and Welfare, Division of Health, Bureau of Environmental Health and Safety (BEHS) requested the Cancer Data Registry of Idaho (CDRI) to conduct an evaluation of cancer incidence. CDRI found elevated cancer rates for the Lewiston ZIP code (83501) and the combined ZIP codes of Lewiston and Clarkston, Washington (99403) when compared **to** the remainder of the State of Idaho. CDRI and BEHS jointly determined the need to evaluate the potential environmental factors associated with the elevated cancer rates for the area and to see if a possible link exists between the Potlatch site and the elevated cancer rates. This health consultation attempts to fulfill that purpose.

**What pollutants were found in the air in the Lewiston/Clarkston Valley?**
Air sampling was conducted in the Lewiston/Clarkston Valley in 1990, 1994, and 1995. Chloroform and benzene were the only two compounds detected at elevated levels. Since benzene is not released by Potlatch Corporation Pulp and Paper Mill, it will be evaluated in a separate health consultation. Chloroform, which is considered to be related by Potlatch, will be evaluated in this health consultation.

**What is chloroform?**
Chloroform is also known as trichloromethane or methyltrichloride. It is a colorless liquid which evaporates very quickly but breaks down slowly once in the air. Most of the chloroform found in the environment comes from industry, such as chemical companies and paper mills**.** Chloroform can enter the air directly from factories that make or use chloroform and through evaporation from water and soil that contain it. It is also found in waste water from sewage treatment plants and drinking water which is treated with chlorine. The chlorination of water produces chloroform as a by-product**.**

**How might I be exposed to chloroform?**
You are probably exposed to small amounts of chloroform in your drinking water and in beverages (such as soft drinks**)** made using water that contains chloroform. Chloroform can also enter your body by eating food, by breathing air, and by skin contact with water that contains it. You are most likely to be exposed to chloroform by drinking water and breathing indoor or outdoor air containing it. In Lewiston/Clarkston Valley, people could be exposed to chloroform in both indoor and outdoor air. Chloroform concentration in outdoor air is lower than that in indoor air. Since Potlatch completed a major modernization of its facility in 1992, the chloroform concentration in the outdoor air decreased dramatically, from 1.61 parts per billion or ppb in 1990 to 0.07 ppb in 1994-1995.

**How can chloroform affect my health?**
Chloroform affects the central nervous system (brain), liver, and kidneys after a person breathes

air or drinks liquids that contain large amounts of chloroform. Breathing about 900 parts of chloroform in a million parts of air (900 ppm or 900,000 ppb**)** for a short time causes fatigue, dizziness, and headache. If you breathe air, eat food, or drink water containing elevated levels of chloroform, over a long period, the chloroform may damage your liver and kidneys. Large amounts of chloroform can cause sores when the chloroform touches your skin. It is not known if chloroform causes reproductive effects or birth defects in humans. Chloroform concentrations measured in both indoor air and outdoor air in residential areas in Lewiston/Clarkston Valley are unlikely to cause any adverse non-carcinogenic public health effects.

Studies have shown that people who drink chlorinated water have shown a possible link between the chloroform in chlorinated water and the occurrence of colon and urinary bladder cancers. Animal studies have shown an association with liver and kidney cancer after long-term exposure to drinking or ingesting chloroform, but it is not known whether humans would develop the same cancers. The Environmental Protection Agency (EPA) classifies chloroform as a probable human carcinogen (cancer-causing agent). The total trihalomethane (including chloroform) in the chlorinated public water from the Lewiston Water Treatment Plant does not exceed the EPA's Maximum Contaminant Level (MCL). Indoor air contaminants in residences could result in a higher increased cancer risk than outdoor air contaminants. The concentration of chloroform in the outdoor air emitted from Potlatch after 1992is not likely to result in an appreciable increased risk of cancer in the exposed population. Therefore, based on the available **data,** BEHS, using **ATSDR's** health hazard categories (Appendix E), considers the air releases from the Potlatch site after 1992 to be no apparent public health hazard**.** Based on chloroform concentrations in the downwind sampling location in 1990, theoretically, the estimated cancer risk is about 40 times higher than that of exposure to the national background chloroform. No data are available for BEHS to evaluate exposures prior to 1990.

**Could exposure to chemical contamination at the site cause an increased rate of cancer in the community?**

It is very difficult to link cancer and environmental exposures. CDRI evaluated cancer incidence between 1992 and 2000 for Lewiston, Idaho and **Clarkston,** Washington and compared the rates to the remainder of the State of Idaho. Several cancer types were found to have elevated rates including: brain, colon, kidney and renal pelvis**,** lung and bronchus, prostate, rectum and rectosigmoid. Leukemia incidence was significantly lower than expected. Even though the incidence of these cancers is elevated, it does not mean that chloroform contamination from the Potlatch facility is causing the cancers. Many factors including genes, lifestyle, and exposure to environmental contaminants add to the risk of developing cancers. Health outcome data analysis indicates more total cancer cases (12%) than expected for the Lewiston/Clarkston Valley area compared to the remainder of Idaho. Currently, it is not possible for BEHS to determine if past exposure to site-related chloroform is associated with the increased cancer incidence.

**Is there a medical test to determine whether I have been exposed to chloroform?**

Although we can measure the amount of chloroform in the air that you breathe out, and in blood, urine, and body tissues, we have no reliable test to determine how much chloroform you have been exposed to or whether you will experience any harmful health effects. The measurement of chloroform in body fluids and tissues may help to determine if you have come into contact with large amounts of chloroform. However, these tests are useful only a short time after you are

exposed to chloroform because it leaves the body quickly. Because it is a breakdown product of other chemicals (chlorinated hydrocarbons), chloroform in your body might also indicate that yon have come into contact with those other chemica1s. Therefore, small amounts of chloroform in the body may indicate exposure to these other chemicals and may not indicate chloroform levels in the environment. Liver enzyme blood tests can show whether the liver has been damaged, but we cannot determine whether the liver damage was caused by chloroform.

**What are the major recommendations of this health consultation and the public health action plan?**

Recommendations:

- Residents should use kitchen and bathroom exhaust fans when cooking and showering, and should maintain good ventilation in the home to minimize chloroform accumulation from water uses, since indoor air chloroform concentrations are higher than outdoor concentrations.

Public health action plan:

- BEHS will conduct health education in the community to explain the findings of this health consultation, assist residents in understanding and mitigating exposure to air contaminants, and provide information about how to reduce cancer risk.

- BEHS will evaluate exposure to benzene in indoor air in the Lewiston area which is not related to the Potlatch site in a separate health consultation.

- BEHS and CDRI will periodically monitor cancer incidence.

Where do I get more information?
If you have questions or comments, please contact Paula Lyon, IDEQ, at 208-769-1422 or plyon@deq.state.id.us; or contact Lijun Jin, BEHS, at 208-334-5682 or jinl@idhw.state.id.us.

## PURPOSE

The Idaho Department of Health and Welfare, Division of Health, Bureau of Environmental Health and Safety (BEHS) in cooperation with the Cancer Data Registry of Idaho (CDRI), conducted a site prioritization project as part of BEHS's cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), The project identified the Potlatch Corporation Pulp and Paper Mill (Potlatch site) as a hazardous waste site of potential public health concern in Idaho due to past air emission and determined that further investigation was warranted. Potlatch is an active facility located relatively close to the downtown area of Lewiston, Idaho (Nez Perce County) and Clarkston, Washington which is a border town in the State of Washington immediately adjacent to Lewiston, Idaho (Appendix A, Figure 1). It is also the major industrial facility in the Lewiston area. The air emissions from the facility have the potential to impact the residential and business areas of the Lewiston/Carkston Valley.

Additionally, CDRI conducted an evaluation of cancer incidence at the request of BEHS. CDRI found elevated cancer rates for the Lewiston ZIP code (83501) and the combined ZIP codes of Lewiston and Clarkston, Washington (99403) when compared to the remainder of the State of Idaho. CDRI and BEHS jointly determined the need to evaluate the potential environmental factors associated with the elevated cancer rates for the area and to see if a possible link exists between the Potlatch site and the elevated cancer rates. This health consultation attempts to fulfill that purpose.

## BACKGROUND AND STATEMENT OF ISSUE

### Site Description and History

The Potlatch site is an active facility located to the northeast of the Lewiston urban area (Appendix A, Figure 11) which began operation in 1952. The Potlatch site is on 787 acres of industrial classified land on the south bank of the Clearwater River, which flows from east to west. Potlatch employs approximately 834 full-time employees and manufactures bleached kraft pulp and paperboard for sale both domestically and internationally. The site contains both a pulp mill and a paper mill. The product of the pulp milling process is pulp fiber and water slurry which, through the use of mechanical and chemical treatment at the paper mill, is turned into various paper products such as napkins, facial and bathroom tissue, paper towels, and paper sheets. The bleaching process and wastewater treatment system at the Potlatch site release chloroform into the ambient air in the Lewiston/Clarkston Valley (IDEQ 1995).

The south and east portions of the site contain the main office, sawmill, machine shop, lumber storage, dry kilns, and chip plant. The consumer products offices, storage, and loading docks are located on the northeast portion of the property. The pulp and paper facilities are located primarily in the north and west areas. The pulp mill uses wood chips and sawdust as raw material and adds them separately to digesters which then utilize a chemical process to break down the lignin holding the cellulose fibers together in the wood. The chip digesters use steam and a sodium hydroxide and sodium sulfide solution (liquor) to break down the wood fibers into a brown wood pulp. The pulp is washed, screened, and the liquor is removed and partiality

recycled. The pulp is then bleached. The predominant bleaching chemical used at the mill is chlorine dioxide. However, in the event of a shortage of chlorine dioxide, a combination of sodium hypochlorite, hydrogen peroxide, and chlorine may be used to bleach the pulp. This process, along with the wastewater treatment plant, releases chloroform into the air.

In 1992, Potlatch completed a major modernization of its facility. A new pulp bleaching system reduced the usage of chlorine. According to the U.S. Environmental Protection Agency's (EPA) Toxic Release Inventory (TRI), chloroform emissions from the mill decreased 69% and chlorine emissions decreased by 95% since the 1992 improvements. The Idaho Department of Environmental Quality (IDEQ) measured a 97% reduction in the average concentration of chloroform in outdoor air around the mill from 1990 to 1994 and a 95% reduction in the average concentration of chloroform in the indoor air in the pulp mill during the same time period (IDEQ 1995).

According to the IDEQ 2002 Source Water Assessment Final Report, concentrations of trichloroethylene, tetrachloroethylene, and cis-1,2-dichloroethylene were detected in samples collected from the pulp mill's two drinking water wells. These detections do not represent a violation of the EPA Maximum Contaminant Levels (MCLs) for drinking water. The source of the contaminants is not known at this time.

### Demographics

There are approximately 15,312 residents and 6,594 households within a 3-mile radius of the facility. For those residents age 25 and older within 3 miles of the site, 50% have two or more years of college, 30% earned their high school diploma, and 20% did not graduate from high school. Additionally, 35% of these residents earn less than $15,000 annually, 18% earn between $15,000and $25,000 annually, 34% earn between $25,000 and $50,000 annually, and the other 13% earn more than $50,000 annually.

## DISCUSSION

### Assessment Methodology

BEHS general1y follows a two-step methodology to evaluate public health issues related to air pollution. First, BEHS obtains representative environmental monitoring data for the site of concern and compiles a comprehensive list of site-related contaminants. Second, BEHS uses health-based comparison values to screen out those contaminants that do not have a realistic possibility of causing adverse health effects. For the remaining contaminants, BEHS reviews recent scientific studies to determine whether the level of environmental contamination and exposure indicates a public health hazard.

The health-based comparison values used in this report are concentrations of contaminants below which the current public health literature suggest will not affect people's health. These comparison values are conservative or cautious, because they include safety or protective factors that account for most sensitive populations. BEHS typically uses comparison values as follows: If a contaminant is never found at levels greater than its comparison value, BEHS concludes the

levels of corresponding contamination are unlikely to result in health effects. If, however, a contaminant is found at levels greater than its comparison value, BEHS designates the chemical as a contaminant of concern and examines potential human exposures in greater detail. Because comparison values axe based on conservative assumptions, the presence of concentrations greater than comparison values does not necessarily suggest that adverse health effects will occur among exposed populations. Using comparison values provides a way to prioritize the contaminants at a site for further evaluation.

**Environmental Contamination**

During the fall 1990, Washington State University and Indaco Air Quality Services, Inc., conducted an ambient air chloroform study in Lewiston in the vicinity of the Potlatch site. A total of 48, 3-hour or 6-hour average air samples were collected over 11 nights at multiple locations upwind and downwind of the mill. Background chloroform concentrations were measured east of the site (sample location C17, Appendix A, Figure 2). Maximum downwind concentrations ranged from approximately 2 to 8 ppb immediately across the river and in North Lewiston (EPA 1991).

IDEQ conducted an annual air monitoring program from July 1, 1994 through June 27, 1995. The goal of the program was to assess the annual average exposure of the general public in the Lewiston and Clarkston area to selected compounds including benzene, toluene, ethylbenzene, meta-, para-and ortho-xylene, and chloroform. Air samples (24-hour average) were collected at one background location and 13 locations through out the Lewiston/Clarkston valley every six days during the study. The background site was selected outside of the study area to establish a baseline for concentrations observed in the area. The site, across the river in north Lewiston, had the largest annual average chloroform concentration of 0.111 ppb. The maximum observed 24-hour average chloroform concentration was 0.46 ppb at the site immediately across the river from the mill. The annual average chloroform level for all sites within the valley (excluding background) was 0.07 ppb and the background chloroform was 0.02 ppb. The annual valley averages for benzene, toluene, ethylbenzene, and xylene were 0.97, 1.53, 0.30, and 1.27 ppb, respectively. The valley area background benzene, toluene, ethylbenzene, and xylene were 0.19, 0.18, 0.03, and 0.24 ppb, respectively (IDEQ 1995). The valley averages were significantly higher than the background.

Indoor air samples were collected February 14 to March 10, 1995 from selected residences in areas represented by most of the outdoor sites. One of the monitoring sites and the background site did not have associated indoor air samples. Indoor air samples were collected at 12 sites every six days during the study. The indoor air average concentrations for benzene, toluene, ethylbenzene, xylene, 1,1,1-trichloroethane, TCE, tetrachloroethylene, and chloroform were 2.54, 12.75, 1.38, 7.64, 4.87, 0.29, 0.56, and 0.61 ppb, respectively.

In most cases, the indoor concentrations exceeded the corresponding outdoor concentrations, which is typical given other indoor sources of chemicals. These include combustion sources such as gas, wood, and tobacco products; building materials and furnishings as diverse as deteriorated, wet or damp carpet, and cabinetry or furniture made of certain pressed wood products; products for household cleaning and maintenance; central heating and cooling systems. For chloroform, the average ratio of indoor concentrations to outdoor concentrations was approximately 10 to 1

(IDEQ 1995). Indoor air chloroform contribution may be from the chlorinated public water. The Lewiston Water Treatment Plant has been chlorinating its water since the 1960s.Because chloroform is relatively volatile, it tends to escape from water into air. Increased release rates of the chloroform in waters can be expected from chloroform-containing waters that are heated (e.g., water used for cooking, showers, and spas).

The total trihalomethane (including chloroform) in the chlorinated public water does not exceed the EPA regulated level. The Lewiston Water Treatment Plant water quality data for trihalomethanes are available from 1984. Trihalomethanes are a group of water disinfection byproducts that include chloroform, bromoform, bromodichloromethane, and dibromochloromethane. Chloroform concentrations ranged from below the detection limit to 98 ppb during 1984 -1994. The average chloroform concentration was approximately 30 ppb. Chloroform has always been present at levels higher than other trihalomethanes. The Lewiston Water Treatment Plant has consistently achieved total trihalomethane levels below 100 ppb, which is the Maximum Contaminant Level (MCL) of total trihalomethanes (EPA 1979).

**Contaminants of Concern**

Concentrations of chemicals in indoor and outdoor air have been compared to health-based air comparison values developed by ATSDR to decide whether any of the chemicals need further evaluation. Health-based comparison values (CVs) are derived using chemical toxicity information and assume daily human exposure to contaminants. For non-cancer toxicity, BEHS typically uses Environmental Media Evaluation Guides (EMEGs), or the EPA's References Concentrations (RfCs). MRLs and RfCs are estimates of daily human exposure to a contaminant that is unlikely to cause adverse non-cancer health effects over a lifetime. Cancer Risk Evaluation Guides (CREGs) are risk comparison values based on EPA's chemical-specific cancer slope factors and an estimated excess lifetime cancer risk of one in one million. Therefore, if the concentration of a chemical is less than its comparison value, it is unlikely that exposure would result in adverse health effects, and further evaluation of exposures to that chemical is not warranted. If the concentration of a chemical exceeds a comparison value, adverse health effects from exposure are not necessarily expected, but potential exposures to that chemical from the site should be evaluated. This health consultation only addresses the site-related air contaminants.

The results are summarized in Appendix B. For l,l,l-trichloroethane, trichloroethylene, toluene, tetrachloroethylene, and ethylbenzene, their concentrations are all less than their respective comparison values. Therefore, exposure to these chemicals is unlikely to result in any adverse public health effects and do not need further evaluation.

For total xylene, the average concentration in indoor air (7.64 ppb) is below the chronic EMEG (100 ppb), and its maximum concentration (116.8 ppb) is much lower than the intermediate EMEG (700 ppb). Therefore, the total xylene is unlikely to result in any adverse chronic or acute public health effects and does not need further evaluation.

For benzene, the average concentrations in indoor and outdoor air are higher than the CREG (0.1 $\mu g/m^3$) (Appendix B). However, benzene is probably not related to emissions from Potlatch, since the Potlatch pulp mill does not seem to release benzene. The benzene air contamination

will be evaluated in a separate health consultation.

For chloroform, the highest concentration in indoor air (8.59 ppb) (Appendix B, Table 2) is lower than the chronic EMEG (20 ppb).Therefore, chloroform in both outdoor and indoor air is unlikely to result in any adverse non-carcinogenic health effects. However, chloroform is also considered to be a probable human carcinogen, and chloroform concentrations in both outdoor and indoor air were higher than the CREG (0.04 µg/m\. The primary source of airborne chloroform in the Lewiston area has been emissions from the bleaching process and wastewater treatment system at the Potlatch pulp mill. Therefore, only the cancer risk of chloroform contamination in the air will be further evaluated in the following section.

**Exposure Pathway**

A completed air exposure pathway of chloroform exists currently, as well as in the past. Higher chloroform concentrations before 1990 could have been possible because Potlatch completed a major modernization of its facility in 1992. It is not possible to estimate air quality for both indoor and outdoor air before 1990 since there are no data available. Future exposure to site-related chloroform through the air pathway is possible.

**Public Health Implications**

As discussed above, chloroform in both outdoor and indoor air is unlikely to result in any adverse non-carcinogenic health effects, but it is still above the CREG. Therefore, this section will only evaluate the cancer risk of chloroform in the air.

Outdoor Air

Some chemicals have the ability to cause cancer. Cancer risk is estimated by multiplying the air contaminant concentration by the unit risk (Appendix C). Cancer risk estimates do not provide definitive answers about whether or not a person will get cancer; rather, they are measures of chance (probability). Cancer is a common illness, and there are many different forms of cancer that result from a variety of causes; not all are fatal. Approximately one quarter to one third of people living in the United States will develop cancer at some point in their lives.

Results from studies of people who drank chlorinated water showed a possible link between the chloroform in chlorinated water and the occurrence of cancer of the colon and urinary bladder (ATSDR 1997b). Cancer of the liver and kidneys developed in rats and mice that ate food or drank water that had large amounts of chloroform in it for a long time. It is not known whether liver and kidney cancer would develop in people after long-term exposure to chloroform in drinking water. Based on animal studies, the Department of Health and Human Services has determined that chloroform may reasonably be anticipated to be a carcinogen. The International Agency for Research on Cancer has determined that chloroform is possibly carcinogenic to humans. The EPA has determined that chloroform is a probable human carcinogen.

The national background level of chloroform in outdoor air is 0.2 $\mu g/m^3$ (Appendix B, Table 1). Based on this value, the estimated cancer risk is about 5 additional cancer cases for 1,000,000

persons exposed over a lifetime.

Based on the chloroform concentration in Lewiston area outdoor air in 1994 and 1995 (Appendix B, Table 3), the estimated cancer risk is about 8 additional cancer cases for 1,000,000 persons exposed over a lifetime, which is similar to the cancer risk of exposure to the national background chloroform. Therefore, the chloroform concentration in the outdoor air emitted from Potlatch after 1992 is unlikely to result in an appreciable increased risk of cancer in the exposed population.

Past exposure to chloroform in the outdoor air was higher before the mill improved its bleaching process. The measured 6-hour (or 3-hour) average chloroform concentration was 2.64 ppb and the average ratio of the 6-hour concentration to the mean 24-hour concentration was 1.64 for chloroform (IDEQ 1995). Consequently, the estimated 24-hour average chloroform concentration was 1.61 ppb. Based on this average concentration in the downwind sampling location in 1990, theoretically, the estimated cancer risk is about 2 additional cancer cases for 10,000 persons exposed over a lifetime, which is about 40 times higher than the cancer risk of exposure to the national background chloroform.

Indoor Air

As discussed before, chloroform in the indoor air may be from the combination of incoming outdoor air containing chloroform and the evaporation of chloroform from all residential chlorinated water uses. Therefore, part of the additional cancer risk may relate to other sources of chloroform (e.g., chlorinated public water) in addition to Potlatch. For persons exposed to the national background level of chloroform (Appendix B, Table 1), the estimated cancer risk is about 2 additional cancer cases for 100,000 persons over a lifetime.

Based on the indoor air concentration of chloroform in 1995 (Appendix B, Table 4), the estimated cancer risk is about 7 additional cancer cases for 100,000 persons exposed to chloroform over a lifetime.

Past exposure to chloroform in the indoor air may have been higher before the mill improved its bleaching process. The indoor air concentrations were approximately 3 to 10 times higher than the outdoor air. BEHS assumes indoor chloroform concentration to be 5 times higher than outdoor chloroform concentrations for the purpose of estimating the concentrations. Based on the estimated 24-hour average chloroform concentration of 1.61 ppb in the outdoor air of the downwind sampling location in 1990, BEHS estimates the indoor concentration of chloroform in 1990 to be 8 ppb. The theoretically estimated cancer risk because of chloroform in indoor air based on the estimated concentrations is about 9 additional cancer cases for 10,000 persons exposed over a lifetime.

**ATSDR Child Health Considerations**

Children differ from adults in their physiology (e.g., respiratory rates relative to body weight), pharmacokinetics (i.e., distribution, absorption, metabolism, and excretion of chemicals), and pharmacyodynamics (i.e., susceptibility of an organ to the exposure). Therefore, it is always

important to address chemical exposures of these sensitive populations. Fetuses, infants, and children are more vulnerable to the toxic effects of chemicals because of the following reasons: 1) children are more likely to play outdoors and bring food into contaminated areas; 2) children are closer to the ground (shorter), resulting in a greater likelihood to breathe dust, soil, and heavy vapors laying on the ground; 3) children weigh less resulting in higher doses of chemical exposure per body weight; and 4) the developing body system can sustain permanent damage if toxic exposures occur during critical growth stages.

Chloroform in indoor and outdoor air is lower than the corresponding non-carcinogenic comparison values, which are also protective of children. Therefore, exposure is unlikely to result in any adverse non-carcinogenic public health effects to both adults and children before or after 1992. The concern about indoor and outdoor air contaminants from the Potlatch site is the cancer risk caused by a lifetime exposure to chloroform. There is no suggestion from available studies of chloroform to indicate that children or fetuses would be qualitatively more sensitive to its effects than adults. This is reflected by the relatively low incidence of spontaneous tumors in developing and young organisms. Therefore, there is no difference between expected health effects for children and adults. The conclusions are the same for both adults and children.

**Health Outcome Data Evaluation**

Data Review

The health outcome data evaluation from the Lewiston area is based on an analysis of available cancer data from CDRI. CDRI is an Idaho Hospital Association program that contracts with Idaho Department of Health and Welfare to provide a statewide cancer surveillance system. The Registry is a population-based cancer registry that collects incidence and survival data on all cancer patients who reside in the State of Idaho and/or are treated for cancer in the State of Idaho. Through collaborative efforts with Idaho's neighboring states, CDRI is able to obtain cancer cases of Idaho residents diagnosed and/or treated for cancer in adjacent states. CDRI has been in operation since 1969 and the registry became population based in 1971. Each Idaho hospital, outpatient surgery center, and pathology laboratory is responsible for reporting cancer diagnoses and treatments within six months after services are provided. CDRI has a 99.6% case completeness rate and a 98.6% accuracy rate. For residents of Clarkston, Washington, information on cancer incidence was obtained from the Washington State Cancer Registry.

The period selected for each evaluation of the cancer incidence data was 1991 or 1992 - 2000. This is the most recent data available for ZIP Code analysis (Washington data begins in 1992). Cancer incidence was reviewed for this health consultation instead of cancer mortality because cancer death rates are affected by how advanced the cancer was at the time of diagnosis, access to health care and other factors not related to exposure. The cancer rates were compared to the remainder of the State of Idaho.

Data Analysis

Cancer incidence for ZIP Codes 83501 and 99403 combined, corresponding to Lewiston and

Clarkston was calculated by comparing the observed number of cases to the expected number of cases (also known as standardized incidence ratio). The expected number was calculated by multiplying rates for the remainder of Idaho and the population of the combined ZIP Codes. The rate for the remainder of Idaho was calculated by dividing the observed cases by the person-years for the remainder of Idaho. Person-years were estimated by summing population estimates for the ZIP Codes over the time period of the study.

To help interpret the differences, the "statistical significance" of the difference is calculated. "Statistical significance" for this health consultation means that there is less than a 5% chance that the observed differences are due to random chance alone ($p<0.05$). In other words, if the differences were found to be statistically significant, then the difference between the expected and observed cases is probably due to some set of factors that influences the rate of that disease. It could be environmental factors, lifestyle factors, and/or family histories. In the health consultation, only statistically significant differences are discussed.

Cancer is not a single disease. It is a group of more than 200 different diseases. Because cancer is, unfortunately, a common disease (one of every three of us will develop cancer in our lifetime), every community will experience a certain number of cancers. Different types of cancer have different causes and are likely to be linked to different risk factors. Therefore, BEHS selected the specific cancer types that are biologically plausible as a result of chloroform exposure according to scientific studies. Chloroform is a probable human carcinogen, which may cause cancer of the colon and urinary bladder, and cancer of the liver and kidney.

Results of Cancer Incidence Analysis

Overall, cancer incidence in the combined ZIP Code area was statistically significantly different from that in the remainder of Idaho. More cases were observed (2,628) than expected (2,342). This represents about 12% more cases than the remainder of Idaho (Appendix D, Table 1).

For selected cancers that might be associated with chloroform exposure (colon, urinary bladder, liver, and kidney), there were significantly more colon cancers as well as female kidney and renal pelvis cancers compared to the remainder of the State (Appendix D, Table 1). Two hundred and forty (240) total colon cancer cases were observed while 185 cases were expected for the combined ZIP Code area, and 34 female kidney and renal pelvis cases were observed while 22 cases were expected for the combined ZIP Code area.

For the female kidney and renal pelvis cancers which might be associated with chloroform, cigarette smoking (which is a leading cause of lung cancer) is also strongly associated with adult kidney cancer, and smokers are at twice the risk of developing kidney cancer as non-smokers (Johnson and Carson, 2003). Based on the literature review (ATSDR 1997b), the elevated colon cancer rate may be related to the chloroform exposure, while strong evidence also exists that diets high in fat and low in fiber (which possibly caused the elevated rectal cancer incidence) contribute to increased risk of colon cancer (Johnson and Carson, 2003). Since no personal specific chloroform exposure data is available for persons diagnosed with such cancers, currently, it is not possible for BEHS to determine the association between exposure to site-related chloroform and the cancer incidence outcome.

Among other cancers with significantly more observed cases than expected (rectal, lung, prostate cancers), some risk factors have been established. Strong evidence exists that diets high in fat and low in fiber contribute to increased risk of rectal cancer. Additionally, individuals with a close family history of these cancers and those with a personal history of certain other cancers are at increased risk. For lung cancer, cigarette smoking, including exposure to second-hand smoke, is the most important risk factor, accounting for over 85% of lung cancer deaths. For prostate cancer, three risk factors are well established: age, family history, and ethnic group/country of residence (Johnson and Carson, 2003). In Idaho, prostate cancer incidence is relatively constant throughout the state. An exception is observed in urban areas due to access to health care and high screening rates. This is likely the reason that more prostate cancers were observed than expected for the combined ZIP Code area (personal communication, Chris Johnson, Cancer Data Registry of Idaho, April 16, 2003).

## CONCLUSIONS

1. Chloroform concentrations measured in both indoor air and outdoor air in residential areas are unlikely to cause any adverse non-carcinogenic public health effects. Indoor air contaminants in residences could result in a higher increased cancer risk than outdoor air contaminants. The concentration of chloroform in the outdoor air emitted from Potlatch after 1992 is not likely to result in an appreciable increased risk of cancer in the exposed population. Based on the available data, BEHS using ATSDR's health hazard categories (Appendix E) considers the air releases from the Potlatch site after 1992 to be no apparent public health hazard.

2. Based on chloroform concentrations in the downwind sampling location in 1990, theoretically, the estimated cancer risk is about 40 times higher than that of exposure to the national background chloroform. No data is available for BEHS to evaluate exposures prior to 1990.

3. Health outcome data analysis indicates more total cancer cases (12%) than expected for this area compared to the remainder of Idaho. Currently, it is not possible for BEHS to determine if past exposure to site-related chloroform is associated with the increased cancer incidence.

## RECOMMENDATIONS

1. Residents should use kitchen and bathroom exhaust fans when cooking and showering, and should maintain good ventilation in the home to minimize chloroform accumulation from water uses, since indoor air chloroform concentrations are higher than outdoor concentrations.

2. Cancer surveillance in the community should continue.

## PUBLIC HEALTH ACTION PLAN

1. BEHS will conduct health education in the community to explain the findings of this health consultation, assist residents in understanding and mitigating exposure to air contaminants, and provide information about how to reduce cancer risk.

2. BEHS will evaluate exposure to benzene in indoor air in the Lewiston area which is not related to the Potlatch site in a separate health consultation.

3. BEHS and CDRI will periodically monitor cancer incidence.

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**CERTIFICATION:**

The Idaho Bureau of Environmental Health and Safety prepared this Public Health Assessment under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the Public Health Assessment was initiated.

_____

Technical Project Officer, SSAB, DRAC

The Superfund Site Assessment Branch (SSAB), Division of Health Assessment and Consultation (DRAC), ATSDR has reviewed this health consultation and concurs with its findings.

_____

Chief, SPS, SSAB, DRAC, ATSDR

# Appendix A

## Maps and Sampling Locations

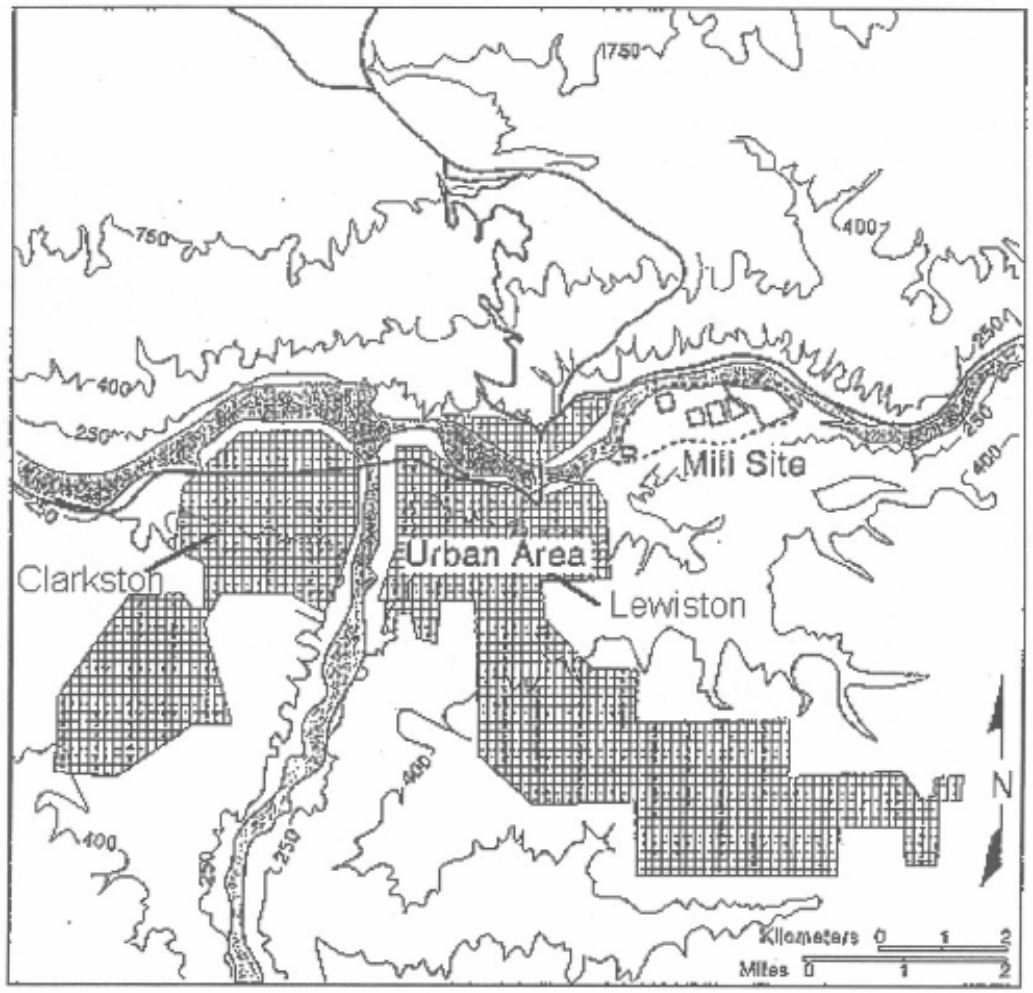


**Figure 1 Potlatch Pulp and Paper Mill Site in Relation to Lewiston, ID and Clarkston, WA**
(Picture adapted from Eltayeb M., Bamesberger L. and Lamb B., 1991)

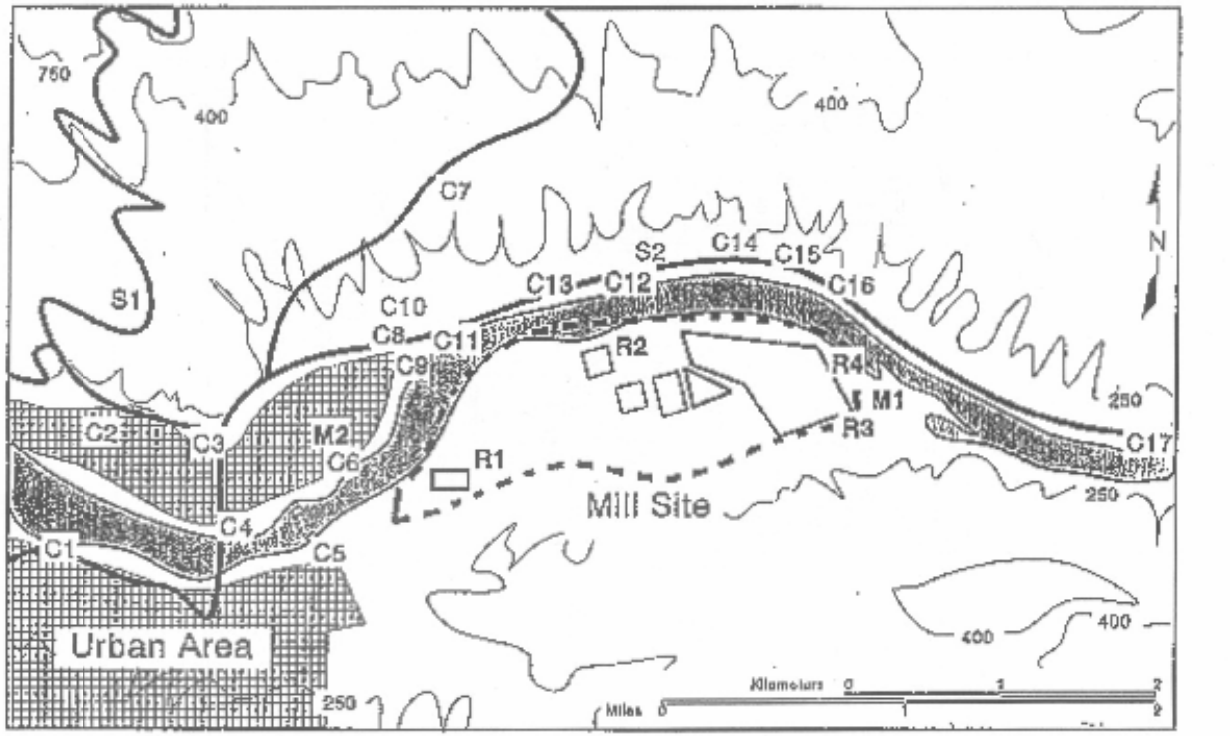


**Figure 2 1990 Chloroform Study Sample Location Map**
(Picture adapted from Eltayeb M., Bamesberger L. and Lamb B., 1991)

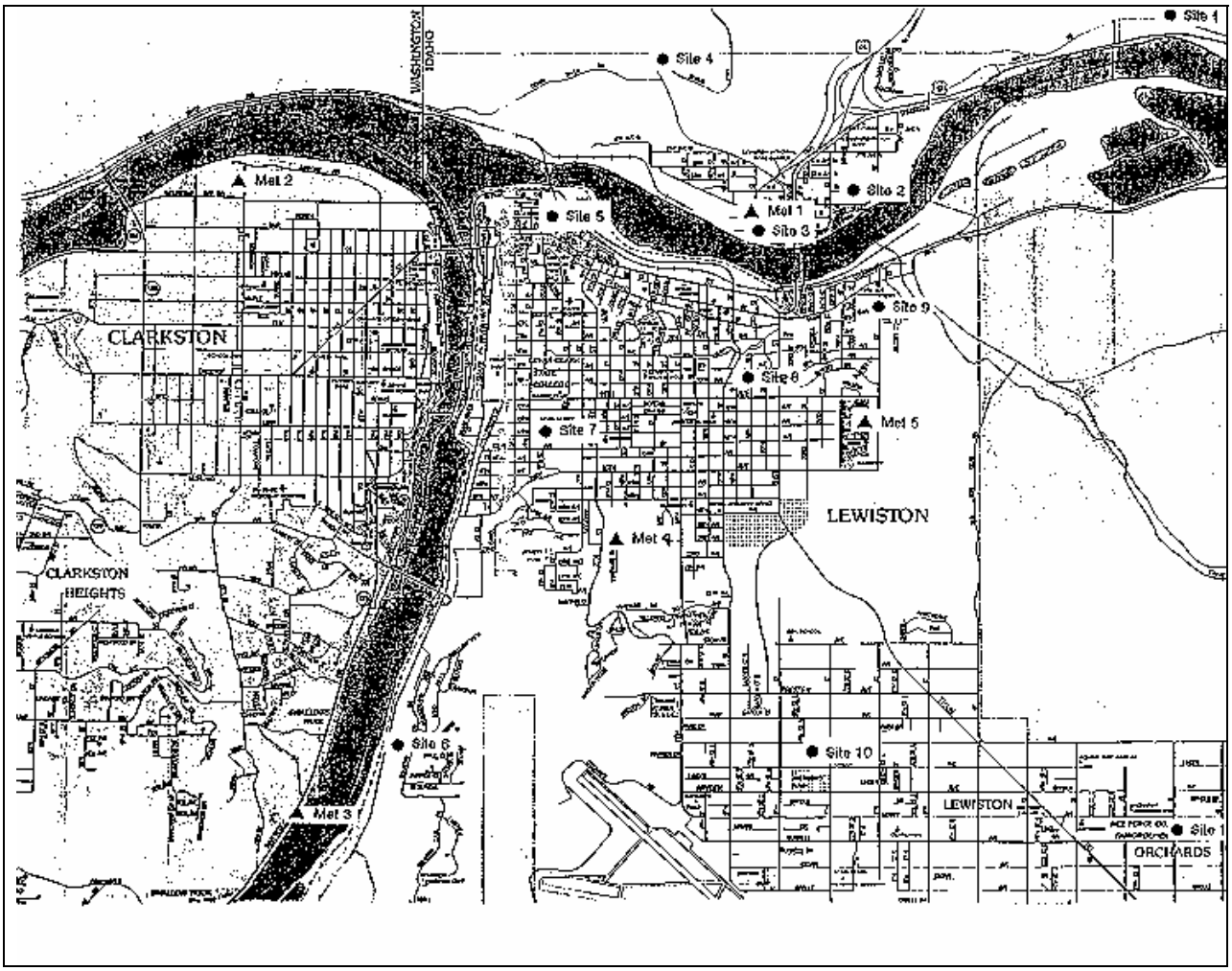


**Figure 2. 1994–1994 Sites for VOC Sampling and Meteorological Monitoring in Lewiston, Idaho**

(Picture adapted from EPA 1995)

**Site Descriptions for Figure 2**

Site 1: Hatwai and 42nd
Site 2: 2611 4th Street
Site 3: End of 1st Street at river
Site 4: Spiral Highway (0.25 miles from Down River Road)
Site 5: 505 C Street
Site 6: Elks Lodge (Country Club Drive)
Site 7: 4th Street and 14th Avenue (Cemetery)
Site 8: Whitman Elementary (19th Street)
Site 9: 29th Street and 5th Avenue
Site 10: McGhee Elementary (Warner Avenue)
Site 11: Midway between Airway and Burrell (Fairgrounds)
Site 12: Scenic overlook on I-95
Site 13: Outside of Uniontown
Site W-1: Clarkston: 10th and Chestnut Street

# Appendix B

## Contaminant of Concern Selection

**Table 1 Air Comparison Values/Screening Values (ppb)**

| Chemical | Non-cancer | | Cancer | | | National Background Level ($\mu g/m^3$) | |
|---|---|---|---|---|---|---|---|
| | CVs (ppb) | Source | CVs ($\mu g/m^3$) | Source | Unit Risk $(\mu g/m^3)^{-1}$ | Outdoor Air | Indoor Air |
| chloroform | 20<br>50<br>100 | c-EMEG<br>i-EMEG<br>a-EMEG | 0.04 | CREG | 0.000023 | 0.2 | 1 |
| 1,1,1-trichloroethane | 700 | i-EMEG | -- | -- | -- | | |
| benzene | 4<br>50 | i-EMEG<br>a-EMEG | 0.1 | CREG | 0.0000078 | 5 | 5 |
| trichloroethylene | 100 | i-EMEG | | | | 0.5 | 5 |
| toluene | 80 | c-EMEG | -- | -- | -- | 5 | 20 |
| tetrachloroethylene | 40 | c-EMEG | -- | -- | -- | 2 | 5 |
| ethylbenzene | 1000 | i-EMEG | -- | -- | -- | 1 | 5 |
| total xylene | 100 | c-EMEG | -- | -- | -- | 10 | 15 |

National Background Level: "Typical" value from EPA 1998
CVs: Comparison Values
c-EMEG: Chronic Environmental Media Evaluation Guide
i-EMEG: Intermediate Environmental Media Evaluation Guide
a-EMEG: Acute Environmental Media Evaluation Guide
CREG: Cancer Risk Evaluation Guide

**Table 2 Ambient Air Sampling Summary, 1990[a]**

| Chloroform | Minimum | Maximum | Average | Minimum | Maximum | Average |
|---|---|---|---|---|---|---|
| | (ppb) | | | ($\mu g/m^3$) | | |
| upwind | ND | 0.18 | 0.053 | ND | 0.88 | 0.26 |
| downwind | 0.06 | 8.59 | 2.64 | 0.29 | 41.94 | 12.89 |

a: 44 3-hour or 6-hour samples (including duplicates) taken during 11 tests from 9 locations
ND: Non-Detect

**Table 3 Ambient Air Sampling Summary, 1994 - 1995[a]**

| Chemical | Minimum | Maximum | Average | Minimum | Maximum | Average |
|---|---|---|---|---|---|---|
| | (ppb) | | | ($\mu g/m^3$) | | |
| chloroform[b] | ND | 0.46 | 0.07 | ND | 2.25 | 0.34 |
| benzene | ND | 14.7 | 0.97 | ND | 46.96 | 3.10 |
| toluene | ND | 21 | 1.53 | ND | | |
| ethylbenzene | ND | 7.08 | 0.3 | ND | | |
| total xylene | ND | 19.38 | 1.27 | ND | | |

a: 930 24-hour samples (including duplicates) taken during 61 tests from 12 locations; 66 background samples.
b: Excluding one outlier, 169 ppb
ND: Non-Detect

**Table 4 Indoor Air Sampling Summary, 1995[a]**

| Chemical | Minimum | Maximum | Average | Minimum | Maximum | Average |
|---|---|---|---|---|---|---|
| | (ppb) | | | ($\mu g/m^3$) | | |
| chloroform | ND | 2.29 | 0.61 | ND | 11.18 | 2.98 |
| 1,1,1-trichloroethane | 0.142 | 106 | 4.87 | | | |
| benzene | 0.16 | 29.1 | 2.54 | 0.51 | 93.0 | 8.11 |
| trichloroethylene | ND | 2.52 | 0.29 | | | |
| toluene | 0.88 | 64.87 | 12.75 | | | |
| tetrachloroethylene | ND | 4.56 | 0.56 | | | |
| ethylbenzene | 0.1 | 17.1 | 1.38 | | | |
| total xylene | 0.45 | 116.8 | 7.64 | | | |

a: 71 samples (including duplicates) taken during 5 tests from 12 locations (site 4 and 13 does not have associated indoor samples).
ND: Non-Detect

# Appendix C

## Cancer Risk Calculations

## Cancer Risk Calculation

$$Risk = C_{ug/m^3} \times UR$$

$$C_{ug/m^3} = C_{ppb} \times \frac{MW(g/mole)}{24.45}$$

Where,

Risk = Cancer risk (unitless)
$C_{\mu g/m^3}$ = Contaminant concentration in the air ($\mu g/m^3$)
UR = Unit risk ($(\mu g/m^3)^{-1}$)
$C_{ppb}$ = Contaminant concentration in the air (parts per billion)
MW = Molecular weight (g/mole)

**APPENDIX D**
**Cancer Incidence Evaluation 1992-2000**

## Table D-1. Cancer Incidence 1992–2000, Comparison Between Lewiston, Idaho, and Clarkston, Washington, ZIP Codes (83501 and 99403) and the Remainder of State of Idaho

| Cancer Site/Type | Sex | ZIP Codes 83501& 99403 Observed Cases | Person Years | Crude Rate (1) | AAI Rate (1,2) | Expected Cases (3) | P-Value (4) | Remainder of Idaho Observed Cases | Person Years | Crude Rate (1) |
|---|---|---|---|---|---|---|---|---|---|---|
| All sites combined | Total | 2,628 | 451,772 | 581.71 | 457.53 | 2,341.9 | 0.000 >> | 41,178 | 10,099,656 | 407.72 |
| All sites combined | Male | 1,453 | 218,079 | 666.27 | 517.49 | 1,220.5 | 0.000 >> | 21,887 | 5,035,288 | 434.67 |
| All sites combined | Female | 1,175 | 233,694 | 502.80 | 399.12 | 1,121.4 | 0.114 | 19,291 | 5,064,368 | 380.92 |
| Bladder | Total | 125 | 451,772 | 27.67 | 21.09 | 115.9 | 0.423 | 1,976 | 10,099,656 | 19.57 |
| Bladder | Male | 97 | 218,079 | 44.48 | 33.52 | 89.3 | 0.442 | 1,554 | 5,035,288 | 30.86 |
| Bladder | Female | 28 | 233,694 | 11.98 | 8.76 | 26.6 | 0.841 | 422 | 5,064,368 | 8.33 |
| Brain | Total | 43 | 451,772 | 9.52 | 8.43 | 34.5 | 0.183 | 684 | 10,099,656 | 6.77 |
| Brain | Male | 31 | 218,079 | 14.22 | 12.62 | 19.4 | 0.018 >> | 397 | 5,035,288 | 7.88 |
| Brain | Female | 12 | 233,694 | 5.13 | 4.48 | 15.2 | 0.505 | 287 | 5,064,368 | 5.67 |
| Breast | Total | 356 | 451,772 | 78.80 | 62.21 | 353.4 | 0.905 | 6,237 | 10,099,656 | 61.75 |
| Breast | Male | 2 | 218,079 | 0.92 | 0.72 | 2.1 | 1.000 | 39 | 5,035,288 | 0.77 |
| Breast | Female | 354 | 233,694 | 151.48 | 123.33 | 351.3 | 0.899 | 6,198 | 5,064,368 | 122.38 |
| Cervix | Female | 18 | 233,694 | 7.70 | 7.02 | 19.7 | 0.813 | 389 | 5,064,368 | 7.68 |
| Colon | Total | 240 | 451,772 | 53.12 | 39.24 | 184.6 | 0.000 >> | 3,049 | 10,099,656 | 30.19 |
| Colon | Male | 116 | 218,079 | 53.19 | 40.14 | 85.9 | 0.002 >> | 1,497 | 5,035,288 | 29.73 |
| Colon | Female | 124 | 233,694 | 53.06 | 38.49 | 98.7 | 0.016 >> | 1,552 | 5,064,368 | 30.65 |
| Endometrium | Female | 69 | 233,694 | 29.53 | 23.68 | 65.3 | 0.679 | 1,135 | 5,064,368 | 22.41 |
| Esophagus | Total | 21 | 451,772 | 4.65 | 3.66 | 21.5 | 1.000 | 378 | 10,099,656 | 3.74 |
| Esophagus | Male | 15 | 218,079 | 6.88 | 5.39 | 16.4 | 0.854 | 297 | 5,035,288 | 5.90 |
| Esophagus | Female | 6 | 233,694 | 2.57 | 1.89 | 5.1 | 0.793 | 81 | 5,064,368 | 1.60 |
| Hodgkin's Lymphoma | Total | 12 | 451,772 | 2.66 | 2.49 | 13.0 | 0.916 | 273 | 10,099,656 | 2.70 |
| Hodgkin's Lymphoma | Male | 8 | 218,079 | 3.67 | 3.43 | 6.9 | 0.787 | 150 | 5,035,288 | 2.98 |
| Hodgkin's Lymphoma | Female | 4 | 233,694 | 1.71 | 1.59 | 6.1 | 0.544 | 123 | 5,064,368 | 2.43 |
| Kidney and Renal Pelvis | Total | 62 | 451,772 | 13.72 | 11.06 | 53.8 | 0.292 | 969 | 10,099,656 | 9.59 |
| Kidney and Renal Pelvis | Male | 28 | 218,079 | 12.84 | 10.36 | 31.7 | 0.588 | 590 | 5,035,288 | 11.72 |
| Kidney and Renal Pelvis | Female | 34 | 233,694 | 14.55 | 11.51 | 22.1 | 0.022 >> | 379 | 5,064,368 | 7.48 |
| Larynx | Total | 21 | 451,772 | 4.65 | 3.77 | 18.0 | 0.537 | 326 | 10,099,656 | 3.23 |
| Larynx | Male | 14 | 218,079 | 6.42 | 5.05 | 14.9 | 0.959 | 270 | 5,035,288 | 5.36 |
| Larynx | Female | 7 | 233,694 | 3.00 | 2.48 | 3.1 | 0.080 | 56 | 5,064,368 | 1.11 |
| Leukemia | Total | 45 | 451,772 | 9.96 | 8.07 | 66.1 | 0.008 << | 1,196 | 10,099,656 | 11.84 |
| Leukemia | Male | 24 | 218,079 | 11.01 | 8.87 | 37.8 | 0.022 << | 704 | 5,035,288 | 13.98 |
| Leukemia | Female | 21 | 233,694 | 8.99 | 7.23 | 28.2 | 0.198 | 492 | 5,064,368 | 9.71 |
| Leukemia - Acute Myeloid | Total | 17 | 451,772 | 3.76 | 2.95 | 16.7 | 1.000 | 293 | 10,099,656 | 2.90 |
| Leukemia - Acute Myeloid | Male | 8 | 218,079 | 3.67 | 2.84 | 10.1 | 0.636 | 181 | 5,035,288 | 3.59 |
| Leukemia - Acute Myeloid | Female | 9 | 233,694 | 3.85 | 3.02 | 6.6 | 0.441 | 112 | 5,064,368 | 2.21 |
| Liver | Total | 13 | 451,772 | 2.88 | 2.21 | 15.3 | 0.671 | 263 | 10,099,656 | 2.60 |
| Liver | Male | 9 | 218,079 | 4.13 | 3.24 | 8.9 | 1.000 | 161 | 5,035,288 | 3.20 |
| Liver | Female | 4 | 233,694 | 1.71 | 1.25 | 6.4 | 0.465 | 102 | 5,064,368 | 2.01 |
| Lung and Bronchus | Total | 384 | 451,772 | 85.00 | 65.34 | 304.2 | 0.000 >> | 5,228 | 10,099,656 | 51.76 |
| Lung and Bronchus | Male | 238 | 218,079 | 109.13 | 83.43 | 176.1 | 0.000 >> | 3,109 | 5,035,288 | 61.74 |
| Lung and Bronchus | Female | 146 | 233,694 | 62.47 | 47.69 | 128.1 | 0.129 | 2,119 | 5,064,368 | 41.84 |
| Melanoma of the Skin | Total | 81 | 451,772 | 17.93 | 15.24 | 88.1 | 0.488 | 1,674 | 10,099,656 | 16.57 |
| Melanoma of the Skin | Male | 48 | 218,079 | 22.01 | 18.36 | 48.7 | 0.997 | 938 | 5,035,288 | 18.63 |
| Melanoma of the Skin | Female | 33 | 233,694 | 14.12 | 12.17 | 39.4 | 0.348 | 736 | 5,064,368 | 14.53 |
| Multiple Myeloma | Total | 34 | 451,772 | 7.53 | 5.73 | 27.1 | 0.224 | 461 | 10,099,656 | 4.56 |
| Multiple Myeloma | Male | 14 | 218,079 | 6.42 | 4.90 | 14.6 | 1.000 | 258 | 5,035,288 | 5.12 |
| Multiple Myeloma | Female | 20 | 233,694 | 8.56 | 6.43 | 12.5 | 0.060 | 203 | 5,064,368 | 4.01 |
| Non-Hodgkin's Lymphoma | Total | 95 | 451,772 | 21.03 | 16.70 | 94.6 | 0.996 | 1,680 | 10,099,656 | 16.63 |
| Non-Hodgkin's Lymphoma | Male | 45 | 218,079 | 20.63 | 16.60 | 47.7 | 0.765 | 886 | 5,035,288 | 17.60 |
| Non-Hodgkin's Lymphoma | Female | 50 | 233,694 | 21.40 | 16.71 | 46.9 | 0.690 | 794 | 5,064,368 | 15.68 |
| Oral Cavity and Pharynx | Total | 65 | 451,772 | 14.39 | 11.63 | 59.8 | 0.533 | 1,080 | 10,099,656 | 10.69 |
| Oral Cavity and Pharynx | Male | 42 | 218,079 | 19.26 | 15.40 | 42.1 | 1.000 | 777 | 5,035,288 | 15.43 |
| Oral Cavity and Pharynx | Female | 23 | 233,694 | 9.84 | 7.77 | 17.7 | 0.258 | 303 | 5,064,368 | 5.98 |
| Ovary | Female | 47 | 233,694 | 20.11 | 16.51 | 47.6 | 1.000 | 847 | 5,064,368 | 16.72 |
| Pancreas | Total | 50 | 451,772 | 11.07 | 8.26 | 51.9 | 0.865 | 866 | 10,099,656 | 8.57 |
| Pancreas | Male | 32 | 218,079 | 14.67 | 11.31 | 24.3 | 0.155 | 433 | 5,035,288 | 8.60 |
| Pancreas | Female | 18 | 233,694 | 7.70 | 5.59 | 27.6 | 0.072 | 433 | 5,064,368 | 8.55 |
| Prostate | Male | 510 | 218,079 | 233.86 | 177.10 | 393.8 | 0.000 >> | 6,885 | 5,035,288 | 136.73 |
| Rectum & Rectosigmoid | Total | 91 | 451,772 | 20.14 | 15.42 | 72.9 | 0.045 >> | 1,248 | 10,099,656 | 12.36 |
| Rectum & Rectosigmoid | Male | 54 | 218,079 | 24.76 | 18.87 | 41.8 | 0.080 | 736 | 5,035,288 | 14.62 |
| Rectum & Rectosigmoid | Female | 37 | 233,694 | 15.83 | 12.03 | 31.1 | 0.332 | 512 | 5,064,368 | 10.11 |
| Stomach | Total | 35 | 451,772 | 7.75 | 5.91 | 32.1 | 0.650 | 547 | 10,099,656 | 5.42 |
| Stomach | Male | 19 | 218,079 | 8.71 | 6.61 | 19.6 | 1.000 | 344 | 5,035,288 | 6.83 |
| Stomach | Female | 16 | 233,694 | 6.85 | 5.16 | 12.4 | 0.376 | 203 | 5,064,368 | 4.01 |
| Testis | Male | 14 | 218,079 | 6.42 | 6.38 | 13.3 | 0.926 | 306 | 5,035,288 | 6.08 |
| Thyroid | Total | 25 | 451,772 | 5.53 | 5.07 | 30.2 | 0.393 | 619 | 10,099,656 | 6.13 |
| Thyroid | Male | 4 | 218,079 | 1.83 | 1.65 | 7.3 | 0.293 | 152 | 5,035,288 | 3.02 |
| Thyroid | Female | 21 | 233,694 | 8.99 | 8.45 | 22.9 | 0.791 | 467 | 5,064,368 | 9.22 |

### Notes

1. Rates are expressed as the number of cases per 100,000 persons per year (person-years).
2. Compare these age and sex-adjusted incidence (AAI) rates to the crude rates for the rest of Idaho.
3. Expected cases are based upon age and sex-specific rates for the rest of Idaho.
4. P-values compare observed and expected cases, are two-tailed, and are based upon the Poisson probability distribution.

"<<" denotes significantly fewer cases observed than expected, ">>" denotes significantly more cases observed than expected (p=.05).

### Statistical Notes

- Rates derived from 10 or fewer cases (numerator) should be interpreted with caution.
- Rates shown for ZIP code analyzes are not comparable to those in state or county analyses due to population estimation procedures.

# Appendix E

## ATSDR Interim Public Health Hazard Categories

## Table E-1. Interim Public Health Hazard Categories

| CATEGORY/DEFINITION | DATA SUFFICIENCY | CRITERIA |
|---|---|---|
| **Urgent Public Health Hazard**<br>This category is used for sites where short-term exposures (<1year) to hazardous substances or conditions could result in adverse health effects that require rapid intervention. | This determination represents a professional judgment that is based on critical data, which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made. | Evaluation of available relevant information* indicated that site-specific conditions or likely exposures have had, are having, or are likely to have in the future, an adverse effect on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the pre of serious physical or safety hazards. |
| **Public Health Hazard**<br>This category is used for sites that pose a public health hazard due to the existence of long-term exposure (>1year) to hazardous substance or conditions that could result in adverse health effects. | This determination represents a professional judgment that is based on critical data, which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made. | Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radionuclides) have had, are having, or are likely to have in the future, an adverse effect on human health that requires one of more public health interventions. Such site-specific exposures may include the presence of serious physical or safety hazards. |
| **Indeterminate Public Health Hazard**<br>This category is used for sites in which "critical" data are insufficient with regard to extent of exposure and/or toxicological properties at estimated exposure levels. | This determination represents a professional judgment that critical data are missing and ATSDR has judged the data are insufficient to support a decision. This does not necessarily imply all data are incomplete; but that some additional data are required to support a decision. | The health assessor much determine, using professional judgment, the "criticality" of such data and the likelihood that the data can be obtained and will be obtained in a timely manner. Where some data are available, even limited data, the health assessor is encouraged to the extent possible to select other hazard categories and to support their decision with clear narrative that explains the limits of the data and the rationale for the decision. |
| **No Apparent Public Health Hazard**<br>This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects. | This determination represents a professional judgment that is based on critical data, which ATSDR considers sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made. | Evaluation of available relevant information* indicates that, under site-specific conditions of exposure, exposures, exposure to site-specific contaminants in the past, present, or future are not likely to result in any adverse impact on human health. |
| **No Public Health Hazard**<br>This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard. | Sufficient evidence indicates that no human exposures to contaminated media have occurred, none are now occurring, and none are likely to occur in the future. | |

* Such as environmental and demographic data; health outcome data; community health concerns information; toxicological, medical, and epidemiological data; monitoring and management plan